**PVP 14**

Code: EC3T3

## II B.Tech - I Semester – Regular Examinations – December 2015

# SIGNAL AND SYSTEMS
## (ELECTRONICS AND COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1. a) Explain the properties of unit impulse function.
   b) Determine whether the following system is stable or not $h(t) = 5\, e^{-2t}\, u(t)$.
   c) Determine whether the following signal is energy signal, power signal or neither x(t)= t u(t).
   d) State frequency shifting and time scaling properties of Fourier transform.
   e) State the necessary and sufficient conditions for the existence of Fourier series of a periodic signal.
   f) Find the ROC of Laplace transform of the signal $x(t) = t\, e^{-2t}.\, u(t)$.
   g) If u(t) denotes the unit step, then what is the Laplace transform of $\frac{d^2u(t)}{dt^2}$.
   h) Determine the signal x(n) for the given Fourier transform $X(j\omega) = e^{-j\omega/2}$ for $-\pi \leq \omega \leq \pi$.
   i) State the linearity and time shifting properties of DFS.
   j) Find the Z- transform of $x(n) = 2^n u(n-2)$.

k) A real-valued signal x(t) is known to be uniquely determined by its samples when the sampling frequency is $\omega_s = 10{,}000\pi$. For what values of $\omega$, $X(j\omega)$ guaranteed to be zero?

## PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) Check whether the following system is 8 M

i) Static or Dynamic

ii) Linear or Nonlinear

iii) Time variant or Time invariant

$$\frac{d^3y(t)}{dt^3} + 5\frac{d^2y(t)}{dt^2} + 6t\frac{dy(t)}{dt} + 2y(t) = x^2(t)$$

b) Obtain the convolution of a given pulse x(t) with itself.

$$x(t) = \begin{cases} 1, & -1 \le t \le 1 \\ 0, & otherwise \end{cases}$$ 8 M

3. a) Find the Fourier transform of 8 M

i) Gate function ii) Signum function.

b) i) Find the trigonometric Fourier series of the function

$$x(t) = \begin{cases} -A, & -\frac{T}{2} < t < 0 \\ A, & 0 < t < \frac{T}{2} \end{cases}$$

ii) Determine the exponential Fourier series and hence find $a_n$ and $b_n$ of the trigonometric series and compare the results.

8 M

4. a) Find x(t) if its bilateral Laplace transform is 8 M

$$X(s) = \frac{2s-3}{(s-2)(s+3)}, \qquad -3 < Re(s) < 2$$

b) Use the convolution theorem of Laplace transform to find $y(t)=x_1(t)*x_2(t)$ for the signals

$x_1(t) = e^{-3t}u(t), \quad x_2(t) = u(t-2).$ 8 M

5. a) Determine the impulse response of the system described by the difference equation $y(n)=0.6y(n-1)-0.08y(n-2)+x(n)$.

8 M

b) State and prove linearity and time shifting properties of discrete time Fourier transform. 8 M

6. a) Determine the inverse Z-transform of the following X(z) by partial fraction expansion method 8 M

$$X(z) = \frac{z+2}{2z^2-7z+3}$$

If ROCs are i) $|z| > 3$ ii) $|z| < \frac{1}{2}$

iii) $\frac{1}{2} < |z| < 3$

b) Find the Nyquist rate and Nyquist interval of the signal $x(t) = 10 \sin 60\pi t \cos 40\pi t$. 8 M